NHDOT SPR2 PROGRAM
RESEARCH PROGRESS REPORT

INSTRUCTIONS:
Project Managers and/or research project investigators should complete a progress report at least every three months during the project duration. Reports are due the 5th of the month following the end of the quarter. Please provide a project update even if no work was done during this reporting period.

Project # 26962M	**Report Period** Year: 2016 ☐Q1 (Jan-Mar) ☐Q2 (Apr-Jun) ☐Q3 (Jul-Sep) XQ4 (Oct-Dec)	
Project Title: Evaluation of Gusset-less Truss Connection to Aid Bridge Inspection and Condition Assessment		
Project Investigator: Erin S. Bell Co-Project Investigator: Ricardo Medina **Phone: (603)862-3850** **E-mail: erin.bell@unh.edu**		
Research Start Date: December 15, 2016	**Research End Date:** December 31, 2018	**Project schedule status:** ☐ On schedule ☐ Ahead of schedule X Behind schedule

Brief Project Description:

The Memorial Bridge connecting Portsmouth, NH and Kittery, ME was re-opened to traffic in 2013. One of the major innovations of the reconstructed bridge is the first ever gusset-less truss connection in a vehicular bridge in the United States. Traditional gusset plates are the most vulnerable element in a truss-bridge structure and a source of significant cost, effort, and concern for bridge managers and owners. The goal of the proposed research is to integrate field-collected performance data, laboratory experimental testing, and physics-based structural modeling to develop a protocol to assess the condition and predict the remaining life of the gusset-less truss connections used at the Memorial Bridge. It is anticipated that the aforementioned approach will be modified to develop a framework to extend this protocol for application to future innovative structural elements.

The objectives of this project are to:

- Create two specimen pairs (A and B) of a scale model of a gusset-less connection from the Memorial Bridge. Specimen pair A will be tested to failure in a quasi-static testing protocol and Specimen pair B will be tested for fatigue performance.
- Conduct quasi-static set of tests on each member of Specimen pair A to determine stress distribution in the connection and failure mode.
- Evaluate these results in conjunction with field collected data and analytical models that are the work product of a complimentary FHWA-AID DEMO project to: (i) further understand and quantify the structural performance of the gusset-less connection, and (ii) validate analytical models.
- Conduct fatigue testing on Specimen pair B and collect performance data to determine the stress pattern and predict fatigue failure mode.
- Compare the findings of this project with the FHWA guideline for connection assessment to facilitate the development of an evaluation protocol for inspection and structural condition assessment.

Progress this Quarter (include meetings, installations, equipment purchases, significant progress, etc.):

Literature Review and Finalize Testing Plan

This literature review and testing plan was started as part of PI Bell's graduate course in advanced steel design. A graduate student, Fernanda Fisher, will complete this task by May 2015 as a funded graduate research assistant in spring 2017.

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Design and Construction of Small-scale Physical Models

A plate buckling specimen was designed as part of the advanced steel graduate course in fall 2017. This specimen is currently being fabricated for testing in February 2017.

Analytical Models of Small-scale Physical Specimens

Preliminary models for the gusset-less connection and plate buckling specimen were created as part of the advanced steel design course in fall 2017. These models will be calibrated with test data over the course of the first year of this project.

Quasi-Static Testing to Failure
There was no progress on this task during this reporting period.

Validation of Structural Connection Analytical Model
There was no progress on this task during this reporting period.

Fatigue Testing
There was no progress on this task during this reporting period.

Data Analysis and Interpretation of Laboratory Testing
There was no progress on this task during this reporting period.

Evaluation Protocol for Inspection and Condition Assessment
There was no progress on this task during this reporting period.

Final Report and Presentation
There was no progress on this task during this reporting period.

Items needed from NHDOT (i.e., Concurrence, Sub-contract, Assignments, Samples, Testing, etc…):

There is no items needed from the NHDOT at this time. The research team would like to request a TAG meeting to review the preliminary testing plan in February 2017.

Anticipated research next 3 months:

Complete design of the testing specimen and testing plan both the plate buckling specimens, bent plate welds and overall specimen.

Fabrication of the plate buckling and bent plate welds specimens.

Testing of the plate buckling specimens for model verification and calibration.

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Circumstances affecting project: Describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope, and budget, along with recommended solutions to those problems.

As described in the "Progress this Quarter" section of this report, the schedule delay and increased cost related to theelectrical conduit negatively impact this project.

Tasks (from Work Plan)	Planned % Complete	Actual % Complete
Evaluation of Gusset-less Truss Connection to Aid Bridge Inspection and Condition Assessment		
Literature Review and Finalize Testing Plan	**10**	**15**
Design and Construction of Small-scale Physical Models	**0**	**0**
Quasi-Static Testing to Failure	**0**	**0**
Validation of Structural Connection Analytical Model	**0**	**0**
Fatigue Testing	**0**	**0**
Data Analysis and Interpretation of Laboratory Testing	**0**	**0**
Evaluation Protocol for Inspection and Condition Assessment	**0**	**0**
Final Report and Poster	**0**	**0**